

Claims

1. A method for producing a particulate carbon product in a reactor vessel wherein gas flow between a gas inlet port and a gas outlet port suspends a bed of catalyst-containing particulate material in said vessel and said particulate carbon product is discharged from said vessel by falling from the bed.
2. A method as claimed in claim 1, wherein the particulate carbon product is prevented from passing through the gas outlet port by means of a gas permeable barrier.
3. A method as claimed in claim 1 or 2, wherein the gas flow between the gas inlet port and gas outlet port is such that the bed is a fluidised bed.
4. A method as claimed in claim 1 or 2, wherein the gas flow between the gas inlet port and gas outlet port is such that the bed is a fixed bed.
5. A method as claimed in any preceding claim wherein catalyst is introduced into the reactor vessel via the gas inlet port.
6. A method as claimed in claim 5, wherein the inlet gas comprises a carbonaceous gas and the catalyst is entrained therein.
7. A method as claimed in any preceding claim wherein the catalyst is a transition metal.
8. A method as claimed in any preceding claim wherein catalyst is introduced into the reactor vessel beneath the bed.

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9. A method as claimed in any preceding claim wherein the catalyst is introduced into the reactor vessel proximate the bed.

10. A method as claimed in any preceding claim wherein the temperature in the bed is between 400 and 900 deg. C.

11. A method as claimed in any of claims 1 to 9 wherein the temperature in the bed is between 550 and 900 deg. C.

12. A method as claimed in any preceding claim wherein the pressure within the bed is between 2 and 25 bar.

13. A method as claimed in any of claims 1 to 11 wherein the pressure within the bed is between 5 and 20 bar.

14. A method as claimed in any of claims 1 to 11 wherein the pressure within the bed is between 5 and 15 bar.

15. A method as claimed in any preceding claim wherein inlet gas is introduced into the reactor vessel at an elevated temperature.

16. A method as claimed in any preceding claim wherein inlet gas is introduced into the reactor vessel via a plurality of gas inlet ports.

17. A method as claimed in claim 16 wherein inlet gas is introduced into the reactor vessel at different temperatures.

18. A method as claimed in any preceding claim wherein carbon particulate product is discharged through a

product outlet port disposed beneath the bed.

19. A reactor comprising a vessel having a gas inlet port, a gas outlet port and a particulate product outlet port, said gas inlet port being arranged such that in use gas flow therefrom suspends a bed of catalyst containing particulate material in said vessel and particulate product is discharged from the reactor by falling from the bed.

20. A reactor arranged to produce carbon nano-fibres comprising a vessel having a gas inlet port, a gas outlet port and a particulate carbon product outlet port, said gas inlet port being arranged such that in use gas flow therefrom suspends a bed of catalyst-containing particulate material in said vessel and particulate carbon product is discharged from said vessel by falling from the bed.

21. A reactor comprising a vessel having a lower section having a gas inlet port and defining a particulate product outlet port, an upper section having a gas outlet port and defining a reaction bed and a middle section connecting said upper and said lower sections wherein in use gas flow from said lower section through said middle section to said upper section suspends a bed of catalyst-containing particulate material in said bed and particulate product is discharged from the vessel by falling from said bed.

22. A reactor as claimed in any of claims 19 to 21, further comprising a gas permeable barrier arranged between the gas outlet port and the bed such that in use particulate product is prevented from passing through the gas outlet port.

23. A reactor as claimed in claim 22, wherein the gas

permeable barrier defines the top of the reactor vessel.

24. A reactor as claimed in claims 22 or 23, wherein the gas permeable barrier is a porous ceramic filter.

25. A reactor as claimed in any of claims 19 to 24, further comprising heating means arranged to heat the bed.

26. A reactor as claimed in any of claims 19 to 25, wherein the reactor vessel is provided with a plurality of gas inlet ports.

27. A reactor as claimed in claim 26, wherein the gas inlet ports are arranged such that in use gas flow therethrough agitates the bed.

28. A reactor as claimed in any of claims 19 to 27 further comprising a catalyst inlet port.

29. A reactor as claimed in claim 28 wherein the catalyst inlet port is arranged such that in use catalyst is introduced proximate the bed.

30. A reactor as claimed in claim 21, wherein the middle section has a smaller cross-sectional area than the upper and lower sections.

31. A reactor comprising a vessel having a gas inlet port a gas outlet port and containing a plurality of reaction surfaces wherein in use a product is synthesised on each of said reaction surfaces and is discharged from the vessel by falling from the reaction surfaces.

32. A reactor as claimed in claim 31, wherein the reaction surfaces are substantially horizontal surfaces.

33. A reactor as claimed in claim 32, wherein the reaction surfaces increase in area towards the bottom of the reactor.
34. A reactor as claimed in any of claims 31 to 33, further comprising a plurality of gas inlet ports.
35. A reactor as claimed in claim 34, wherein the gas inlet ports are arranged to supply inlet gas to each of the reaction surfaces.
36. A reactor as claimed in any of claims 31 to 35, further comprising a product outlet port arranged beneath the reaction surfaces.
37. A reactor comprising a vessel having a plurality of gas inlet ports, a gas outlet port and a particulate product outlet port, wherein in use a reaction bed is formed in said vessel containing a bed of catalyst-containing particulate material and said gas inlet ports are disposed so as to introduce inlet gas directly into the reaction bed.
38. A reactor as claimed in claim 37, wherein the gas inlet ports are arranged at an angle to the vessel such that in use inlet gas acts to agitate the bed.
39. A reactor as claimed in claim 37 or 38, wherein the vessel is disposed in a horizontal orientation.
40. A reactor as claimed in claim 39, wherein a plurality of product outlet ports are disposed along the length of the vessel.
41. A reactor as claimed in any of claims 37 to 40, further comprising vessel rotation means such that the

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vessel can be rotated in use to agitate the bed.

42. A reactor as claimed in claim 41 further comprising stirring means connected to the internal surface of the vessel.

43. A reactor as claimed in any of claims 19 to 42, wherein the reactor vessel is internally lined with a ceramic material.